3.5 SIMIQ

3.5.1 Location and Site Description – Simiq

The Simiq site is located approximately 4 miles north-northeast of the existing village and 2.5 miles north-northeast of the west side of the lagoon, over muskeg terrain. The maximum extents of the elevated portions of the site are ½ mile wide in the east-west direction and between ¾ and 1 mile long in the north-south direction. The site is raised above the tundra pond terrain to the west by about 20 ft. Its highest elevation is in the approximate center of the site about 200 yards from the west shoulder. The site grade tapers off in all directions from this area at slopes of less than 5%. To the west and southwest, the gradual slope extends for several hundred yards.

The north and west sides of the site terminate into bluffs that drop off a maximum of 30 ft and 20 ft, respectively. The west face of the site tapers from the middle to each end, blending into the tundra pond/muskeg very gradually. The north face of the site is shorter than the west face, with a slope that drops off to the muskeg below at approximately 45 degrees.

Reference the geotechnical portions of this report for the composition and temperatures of the site soils.

The site is covered in low tundra growth characterized by sedges, scrub alder, and Arctic Willow. Berries, such as crowberries, blueberries and cranberries, along with tundra flowers and arctic cotton grass can also be found in the tundra. There are no trees on the site, and the scrub willows and alders are located only on the north and west faces.

The site is wet between the tundra grass tussocks and has small tundra ponds at the edges. Walking is difficult. Preliminary investigations show frozen ground at a depth of 3 inches with ice from 1.5 feet to at least 25 feet in depth. The active layer of the site is composed of saturated plastic silts with no sand or gravel.

Drainage of the site is facilitated by little infiltration into the saturated subsoils and micro-channel flow around tussocks to major drainage swales on the west and north sides of the site. These existing channels are shallow and do not extend into the site more than 50 feet from the swale..

The location of the Simiq site, inland from the lagoon, places it far enough away from the Chukchi Sea so that watching for whales from the site will not be possible, in spite of being higher than the surrounding terrain.

3.5.2 Site Development – Simiq

Reference the geotechnical report regarding the depth of gravel recommended to maintain the thermal regime of the site after development. The depth of fill applied to the site is determined by maintenance of the existing frozen thermal regime. Appendix G shows a conceptual layout of infrastructure.

The fill depth should be a minimum of 9 ft, and deeper in those areas called for by grading. Reference Section 3 for a discussion of gravel depth determination criteria.

Grading should maximize the utilization of swales and roadside ditching as much as possible. Where lengths of grade and slopes combine to make swales and ditches too deep, drainage structures such as culverts, manholes, catch basins and subsurface piping shall be employed.

General site grades should be kept to the minimum 2% on undeveloped (soil) surfaces as much as possible, and less than the minimum slopes that promote scour and erosion for the soils used. Pipe grades should be the minimum 1%. Storm drainage

outfalls should be rock-lined to prevent erosion .

3.5.2.1 Construction Considerations – Simiq

Initial geotechnical investigations of Simiq assume that the site is underlain by highly thaw-unstable permafrost. Ongoing follow-up geotechnical investigations may change the assessment.

Based on thaw unstable conditions, construction considerations for the site should consider the presence of thaw-unstable, ice-rich fine-grained materials. Significant settlement should be expected if thawing occurs.

For a site with these conditions, R&M (2000 & 2002) and Shannon and Wilson (2004) suggest the use of pile foundations or a granular fill pad with a post-on-pad foundation to protect from settlement due to thawing of ice-rich soil. Post-on-pad foundations are for areas with little or no massive ice, and require periodic leveling. Another option would be insulated and/or refrigerated shallow foundations; however this method is generally not used for ice-rich conditions and maintenance cost could be very high.

Embankments for roads and runways will also need to be protected from settlement due to permafrost degradation. An estimated embankment thickness of 9 feet should reduce the depth of thaw penetration into the ice-rich soil to nearly zero. Rigid board insulation or allowing for some settlement can reduce embankment thickness. The settlement would occur mostly within the first few years of service. Culverts beneath the embankments are expected to settle due to permafrost degradation, and may need to be re-leveled periodically during the first few years of service. Insulation beneath the culverts may reduce the magnitude of settlement.

Direct bury of settlement-sensitive gravity, pressure, or vacuum sewer systems might be risky due to the settlement potential. Unless the thermal impacts to the permafrost can be minimized by the design, utilities might have to be located above ground.

3.5.3 Infrastructure Development – Simiq

3.5.3.1 Water – Simiq

The closest feasible surface water source to Simiq would be either the Kivalina or Wulik Rivers. TNH visited two ponds adjacent to the west and northeast of the site (in August 2004). The ponds are approximately 11 and 3 acres in size, respectively. Neither appeared to be capable of use as a year-round water supply. Ponds along the southeast side of the Simiq site were not visited, however, they are similar in size to the west and northeast ponds. Ponds in the area typically freeze to the bottom in winter (DOWL 1994).

Simiq is centrally located between the two rivers. Piping distances of 1-1/2 to 2 miles would be required to access either of these sources.

If a surface water source from one of the rivers were used for Simiq, a collection, treatment, and distribution arrangement similar to the existing Kivalina site would be required. Water would be withdrawn through a hose and pipe transmission line placed in the river and pumped to a raw water storage tank (RWST). If the rivers could be tapped with an infiltration gallery year round, the transmission line would have to be heated with a glycol loop to avoid freezing.

Due to the potential for massive ice wedges and unstable thaw conditions, an underground distribution system is likely not feasible at the Simiq site (S&W 2004). If an aboveground distribution system were used,

continuous grade adjustments would be needed.

3.5.3.2 Wastewater – Simiq

Simiq has a slope of less than 5%, and appears to have ice-rich permafrost. The gentle slope of the terrain would allow for a gravity collection system for wastewater disposal. The ice-rich permafrost soils would limit the design to an aboveground arctic pipe system. A pump station located at the base of the slope could collect all the wastewater if needed. A naturally-occurring tundra pond could be used for wastewater disposal.

3.5.3.3 Solid Waste – Simiq

The potential village site is a high point in a swampy area. The land surrounding the site is lower by as much as 50 feet. Based on an August 2004 site visit, there is no location readily suitable for a solid waste site within 2 miles of the potential village site at Simiq. To reach potential solid waste sites to the northeast or east of the site, additional roads of one or more miles would have to be constructed. No nearby gravel source is present, and the very poor soils in the Simiq area would require import of gravel to build roads.

All the land around the site is low enough to be affected by floodwaters of the 100 and 500-year floods. Any solid waste dump located northeast or east of the Simiq site would need to be constructed so that the possibility of flooding is eliminated.

3.5.3.4 Fuel – Simiq

Except for the location of marine headers and fill pipeline routings, the information in 3.2.6 Fuel applies to all potential sites equally.

3.5.3.5 Heating – Simiq

The information in 3.2.7 Heating applies equally to all sites.

3.5.3.6 Electricity – Simiq

The information in 3.2.8 Electricity applies equally to all sites.

3.5.4 Access – Simiq

Road access to the Simiq site from the lagoon may entail construction of a road approximately 3.5 miles long over muskeg type soils from the west side of the lagoon. This road would allow access from the village to boats moored in the lagoon, and from a barge landing on the lagoon to the village.

There is no regular trail access to the Simiq site. Community members questioned about access indicated that a trip from the lagoon to the site takes about a day via four-wheeler due to the poor conditions of the terrain.

Road prism size for an access road from the lagoon to the site would be approximately 5 ft tall at the shoulders with 2:1 side slopes and have a volume of 6.7 cubic yards of material per lineal foot of road length. In addition, a staging pad having an area of approximately one acre may be required at the barge-mooring site. With a gravel depth of 5 ft, this would require an additional 8,800 cubic yards of gravel over geotextile fabric. Regrading of the roads may be required since some thawing of permafrost is anticipated with embankment depths of less than 9 feet.

3.5.4.1 Access for Subsistence Activities – Simiq

The Simiq site has no direct access to the Chukchi Sea. All sea access should be by road to the lagoon and then by boat across the lagoon, out the Singauk Inlet to reach the sea. All equipment needed for marine subsistence activities, all game obtained, and equipment to be stored may need to be hauled across the village access road to the lagoon. The 3.5-mile road distance could make hauling larger items, such as boat

engines and small boats needing repair, difficult with the existing vehicles available in the village.

The location of the site, inland from the lagoon, places it far enough away from the Chukchi Sea so that watching for whales from the site will not be possible, in spite of the elevation being above the surrounding terrain.

The nearest point on a river to the site is a northerly loop of the Wulik River approximately 1.2 miles south of the southern edge of the site. No direct access to any river is planned. Access to all rivers is to be gained from the lagoon.

Beach access may be difficult from the Simiq site. To access beaches north or south of Singauk Inlet, a resident may have to traverse the lagoon access road and take a small boat across the lagoon.

Winter travel by snowmobile should be much easier; as the community members can drive anywhere the ice is thick enough to support the vehicle.

3.5.4.2 Goods & Supplies – Simiq

The main source of goods and supplies for the new village should be by barge. A new barge landing and access road will need to be designed and constructed on the beach on the west side of the lagoon, approximately two miles northwest of the current town site. An access road crossing the lagoon would require culverts placed within the lagoon. Supplies would then need to be transported approximately four miles overland from the barge landing site to the new village site.

Goods and supplies can also be transported to the village via the airstrip, the location of which is discussed in the following section.

3.5.4.3 Air Transportation – Simiq

For the purposes of this study, we have selected a possible airstrip location approximately 5,000 feet southeast of the village. This site would require a road of approximately 6,500 feet, along which the Additional information will be gathered during the Stage II study to determine the best location and design considerations for a new airstrip. For the purposes of this study, we have selected a location approximately 1 mile east of the site on a low ridge. A new airport should be constructed prior to occupancy of the new village site. Refer to Section 3.1 for general recommendations.

3.5.4.4 Roads and Streets within Community – Simiq

The road layout within the community is expected to closely reflect the plan in Appendix G for the Phase I study report. Roads should be designed on a grid system to maximize flow of traffic and access to all portions of the new community.

The thermal regime described in the geotechnical report for the Simiq site may require a gravel pad a minimum of 9 feet thick.

3.5.4.5 Roads Outside the Community – Simiq

The location of the Simiq site and the soil conditions of the surrounding terrain make road construction difficult and expensive. The very poor soils in the area of the Simiq site preclude any specific development of roads outside the village except to access the airstrip and solid waste site. It is anticipated that there should be as few roads as possible outside the village to access the new airstrip, the solid waste facility, and the lagoon boat moorage area. To reduce the amount of road development necessary, two or more of these facilities should be located along the same road.

We have routed two roads connecting the village site to the barge landing and the runway. The barge access road should be 3.5 miles long and extend to the west from

the site. The runway access road should be 1 mile long and extend to the east from the site.

3.5.5 Native Allotments

There are no Native allotments in the vicinity of the Simiq townsite (see Figure 5). However, there are two Native allotments along the Wulik River near a potential airport site. Siting of an airport at this site should be able to avoid the Native allotments.

3.5.6 Relocation Costs – Simiq

Design and construction administration are not included in the following construction cost estimate for relocation to Simiq. The cost estimate to build a new village site at Simiq is **$251.5 million**. Detailed costs are included in Appendix A. A summary is included below:

Site work and Airport Construction	$167,400,000
Erosion Protection	$231,000
Construction Camp	$606,000
Power and Fuel	$5,292,000
Move Buildings	$1,125,000
New Buildings	$52,690,000
Water/Sewer System and Landfill	$21,119,261
Transportation System	$3,056,000
Total Cost	**$251,500,000**

3.5.7 Recommended Plan for Simiq

The Simiq site is located the greatest distance from the Chukchi Sea and the lagoon. This means the Simiq access road will be one of the longest out of the six mainland sites, along with that of the Kuugruaq site. The access road should be around 3.5 miles long over the lagoon and over muskeg that does not provide adequate support for the gravel road prism. Geotextile fabric should be placed in order to support the gravel road base. Even with this addition, the stability of the road may not be good.

The barge landing and should be established on the east side of the Singauk Entrance at the head of the new village access road. Accessing the village road through the existing Singauk Entrance may require the construction of a directional dike to channel the flow of the Wulik River to prevent it from depositing silt in the entrance and requiring intermittent maintenance dredging.

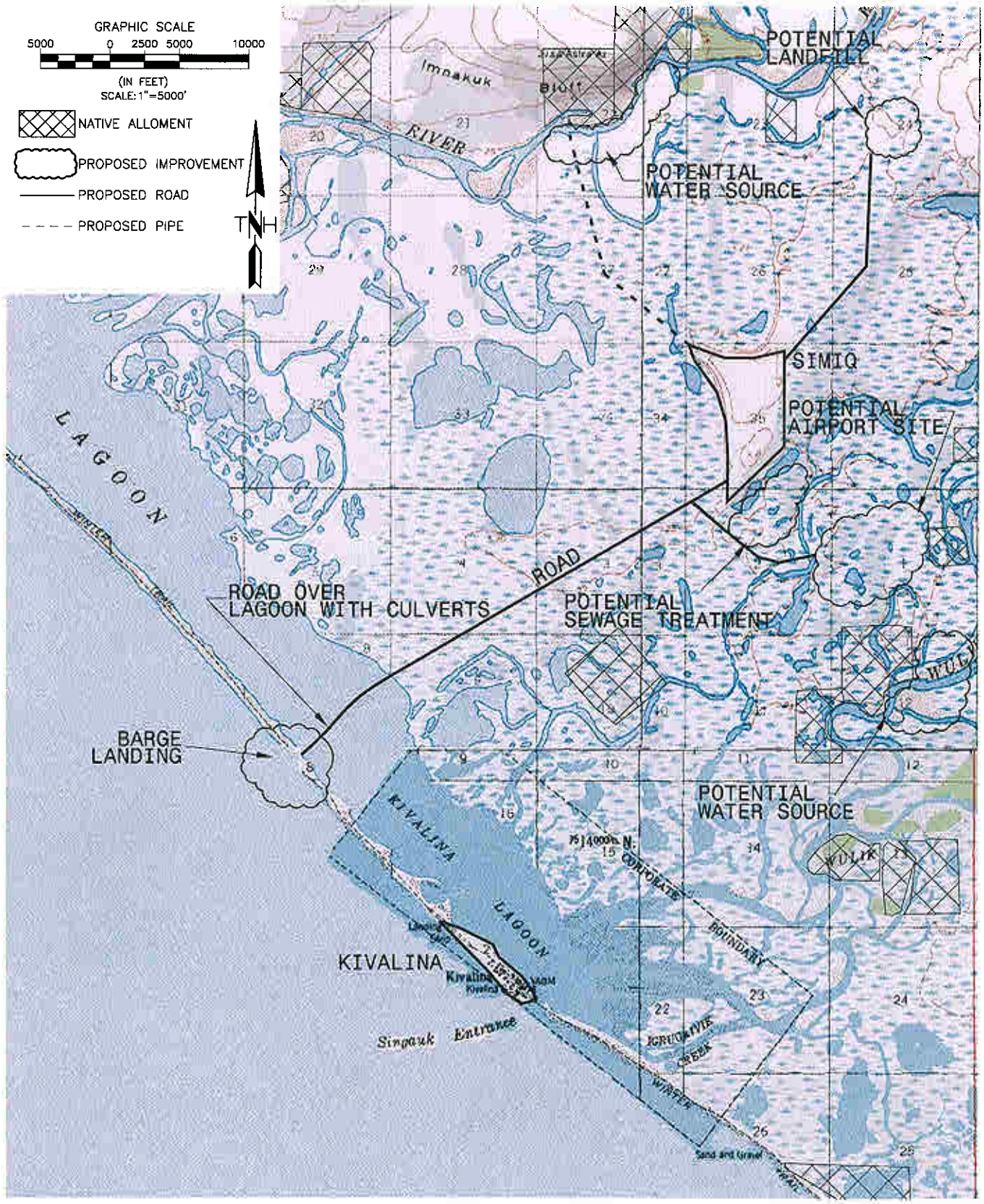
The area to be investigated for the runway to serve the Simiq site is located approximately 1 mile east of the town site along the lower slopes of Klaimigiuktuk Mountain. It is anticipated that this area should provide better subgrade on which to base the 150 ft X 4,000 ft runway. Locating the runway here should provide a better base, but necessitate an additional mile of access road.

Raw water for the Simiq site will most likely come from the Kivalina River approximately 2 miles to the northwest of the new village site. A surface water intake and gravel sump may need to be developed in the river at a depth that will provide year round water and avoid freeze-up during the winter.

Our recommendation for the siting of the landfill for Simiq is close to the village on the west side of the site. This side of the town site is lower than the site itself. A location close to the village should ensure that solid waste makes it to the landfill, and this area should provide some protection from the winds. By placing the landfill on the west side of the town site, access to haul

recyclable materials, batteries, and hazmat to the barge landing for shipping out of the area should be easier. In addition, this location will place the village between the landfill and the runway, and ensure a minimum of 10,000 ft between the landfill and runway.

Siting the sewage lagoon to the northwest of the village site should provide excellent separation between the wastewater treatment unit and raw water intake site. Discharge of the treated effluent into the surrounding muskeg should increase treatment in a 'bioswale' type environment.



XREF's/IMAGES USED FOR THIS DWG:

PLOTTED: 06/16/06 TIME: 4:15 pm

LAYER MGR: *.lay CTB FILE: *.ctb

DRAWING NAME: village site infrastructure maps.dwg

ENGINEERING/SURVEYING & LANDSCAPE ARCHITECTURE
TRYCK NYMAN HAYES, INC.
911 W. 8TH AVENUE, SUITE 300
ANCHORAGE, AK 99501-3497
TEL: (907)279-0543 • FAX: (907)276-7679

Figure 7

SIMIQ CONCEPTUAL LAYOUT

DESIGN BY: MEW	DATE: 6/16/06
DRAWN BY: JT	PROJECT No: 03003.007
SCALE: 1" = 5000'	REV. –
CAD DWG FILE:	
FIELD BOOK: –	SHEET 1 OF 1
GRID: –	

Simiq, Photo 1

View NE from E edge of Simiq site

Simiq, Photo 4

View of Kivalina from Simiq site

Simiq, Photo 2

Looking E from Simiq landing site

Simiq, Photo 5

Wet drainage swale on E side of Simiq site

Simiq, Photo 3

View of pond SE of landing site at Simiq

Simiq, Photo 6

Aerial view of Simiq site

KIVALINA VILLAGE
RELOCATION PROJECT

FIGURE 6 SIMIQ

PHOTOS BY TRYCK NYMAN HAYES, INC., AUGUST 24, 2004
KIVALINA, ALASKA

SHEET 1 of 1

FILE NAME KIVALINA_SIMIQ.DWG

DESIGNED OFC
DRAWN OFC
CHECKED MEW
DATE 10/10/05
GRID
JOB NO. 03003.007

FIELD BOOKS
DESIGN
STAKING
AS-BUILT
SCALE HOR. AS SHOWN VER.

REV. | DATE | BY | REVISION

PLOT SCALE: 1:1